



Course Objective

- To enable students to understand and apply underlying electrical and electronic principles in engineering systems.

Course Outline

1. Introduction

- **Basic Concepts**
 - System of Units
 - Charge, Coulomb's Law, Electric Field
 - Current and Voltage
 - Power, the Passive Sign Convention, Energy
 - Circuit Elements
- **Basic Laws**
 - Ohm's Law
 - Kirchhoff's Law
 - Nodes, Branches, Loops and Meshes
 - Series Resistors and Voltage Division
 - Parallel Resistors and Current Division
 - Wye (Y) - Delta (Δ) Transformation

2. DC Circuit Analysis

- Nodal Analysis
- Nodal Analysis with Voltage Sources
- Mesh Analysis
- Mesh Analysis with Current Sources

3. Circuit Theorems

- Linearity and Principle of Superposition
- Source Transformation
- Thevenin's Theorem
- Norton's Theorem
- Maximum Power Transfer

4. Transient Analysis – First and Second Order Circuits

- Inductors and Capacitors
- Series and Parallel Connection
- First Order Circuits
 - Source Free RC and RL Circuits
 - Step Response of RC and RL Circuits
- Second Order Circuits
 - Source Free Series RLC and Parallel RLC Circuits
 - Step Response of Series and Parallel RLC Circuits

5. Sinusoidal Steady-State Analysis

- Review of Complex Algebra
- Sinusoids and Phasors
- Impedance and Admittance
- Nodal and Mesh Analysis
- Superposition theorem
- Source Transformation
- Thevenin and Norton Theorem
- Frequency Response and Resonance

6. AC Power Analysis

- Instantaneous, Average, Reactive and Complex Power
- Maximum Average Power Transfer
- Effective or RMS Value
- Apparent Power, Power Factor and Power Factor Correction

EVALUATION

Tests and Assignments (50%),
Final Exam (50%)

REFERENCES

1. C.K. Alexander & M. N.O. Sadiku, *Fundamentals of Electric Circuits, 7th Edition*, NY, 2021
2. J. D. Irwin and R. M. Nelms, *Basic Engineering Circuit Analysis, 12th Edition*, John Wiley & Sons, NJ, 2021
3. R. C. Dorf and J. A. Svoboda, *Introduction to Electric Circuits, 9th Edition*, John Wiley & Sons, NJ, 2013
4. W. H. Hayt, J.E. Kemmerly, and S. M. Durbin, *Engineering Circuit Analysis, 10th Edition*, McGraw Hill, NY, 2024